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Grid Performance Issues in BeSC e-Science Projects

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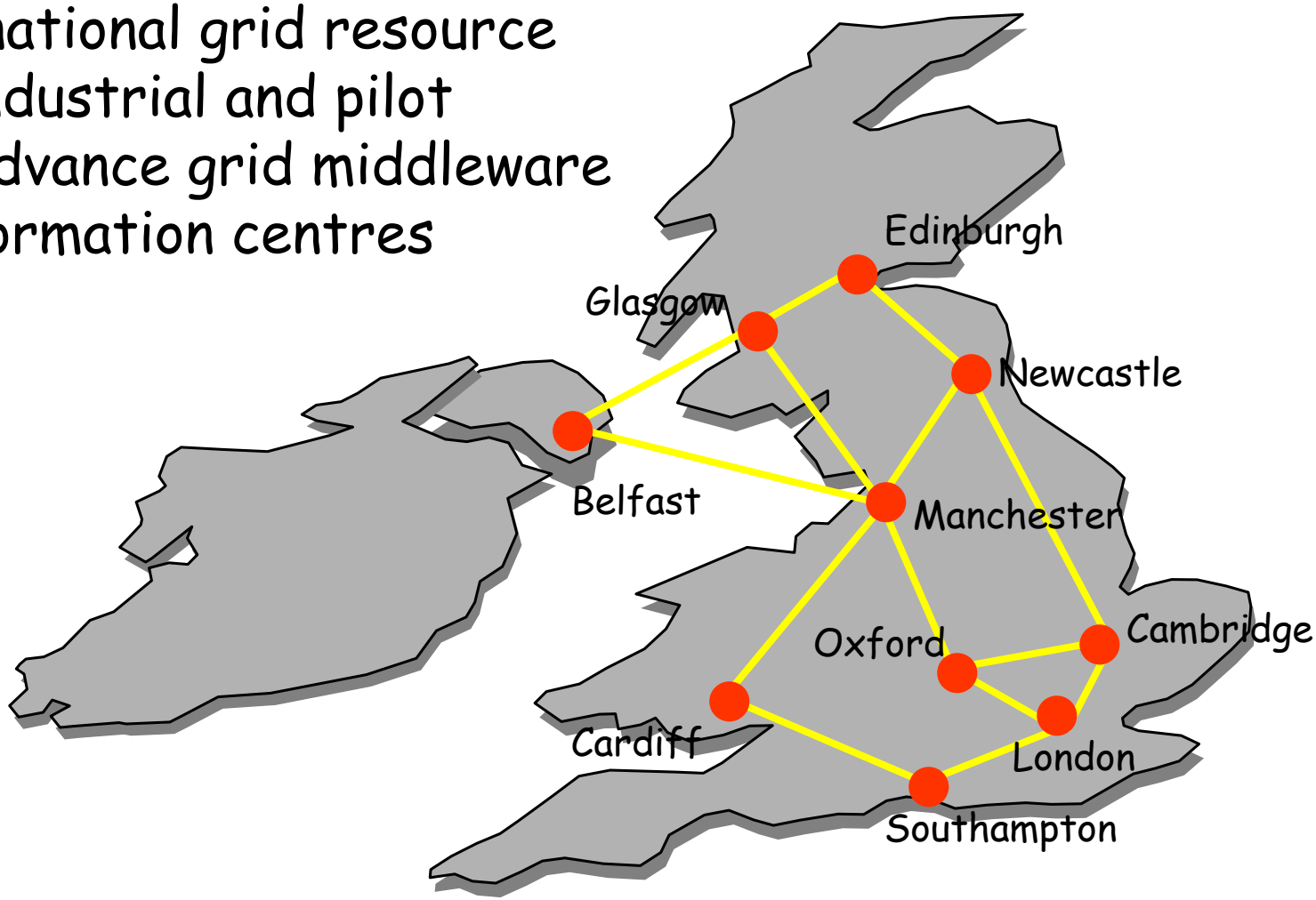
UK e-Science Grid

- Provide a national grid resource
- Through industrial and pilot projects advance grid middleware
- Act as information centres



Talk Overview

- Academic Project
  - GT2 based
  - Large scale atomic physics calculation
- Commercial Projects
  - GT3/web services based
  1. Broadcast Media
  2. High performance data cleansing and mining

Talk Overview (continued)

- Academic Project
  - Large scale atomic physics calculation
    - Research tool developing a grid solution for a legacy high-performance computer system
  - Comparison with supercomputer implementations
- Commercial Projects
  - Broadcast Media
    - Prototyping large scale data movements
    - Timings based on broadcast infrastructure scenarios
  - High performance data cleansing and mining
    - Prototyping (and using commercially) cleansing and mining
    - Mining/cleansing technology based on utility computing and remote service provision

2DRMP-G
The 2-d R-matrix Propagator Application

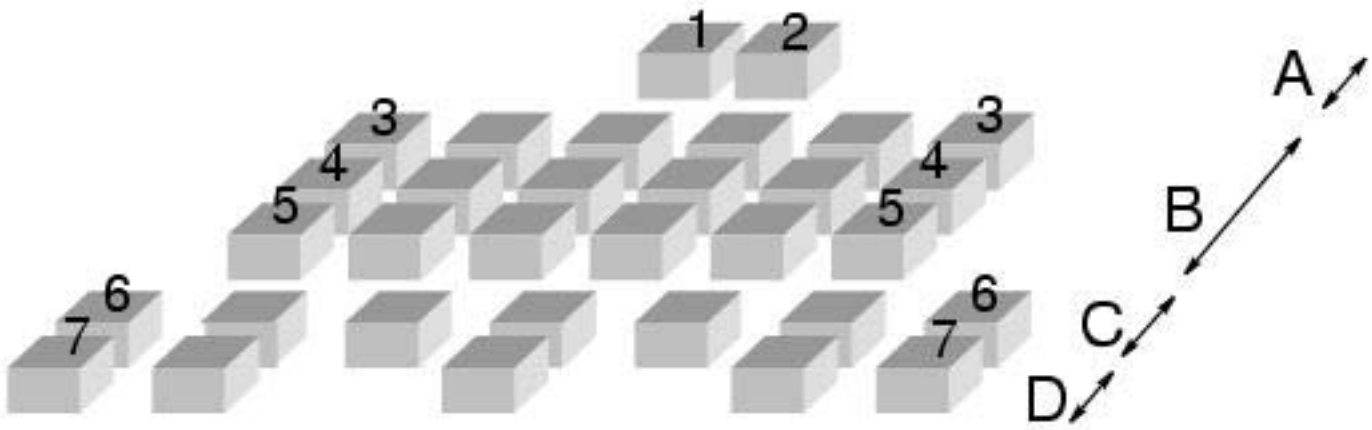
Some Background

- What is 2DRM used for?
  - Calculation of atomic collision data
  - Data is useful in analysis of physical phenomena
    - Laser physics, plasma physics, atmospheric physics, astronomy
  - Test ground for computational approaches
- Why?
  - Relatively little accurate cross-section data is known for many of the processes that are modelled
    - Accurate simulation of electron impact and excitation is difficult
  - Recent theoretical and computational advances enable the accurate study of electron collision for H-like atoms at intermediate energies

Development History

- Development started in Autumn 2002
  - GT2
- Deployed on UK grid January 2003
- Operational as a physics tool since March 2003
- Running almost every day since March 2003
  - As a computational tool and a robustness tool for UK L2G

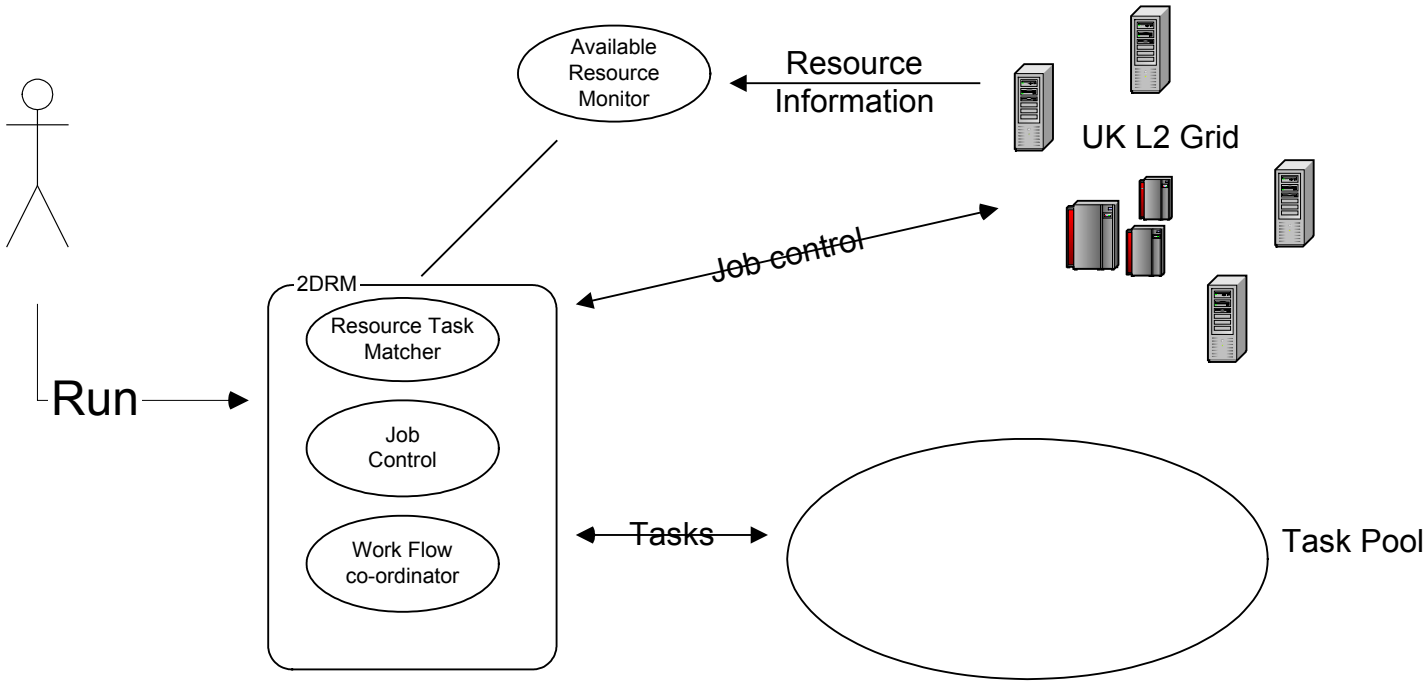
The Solution Structure



Collection of stages organised as conceptual blocks A to D

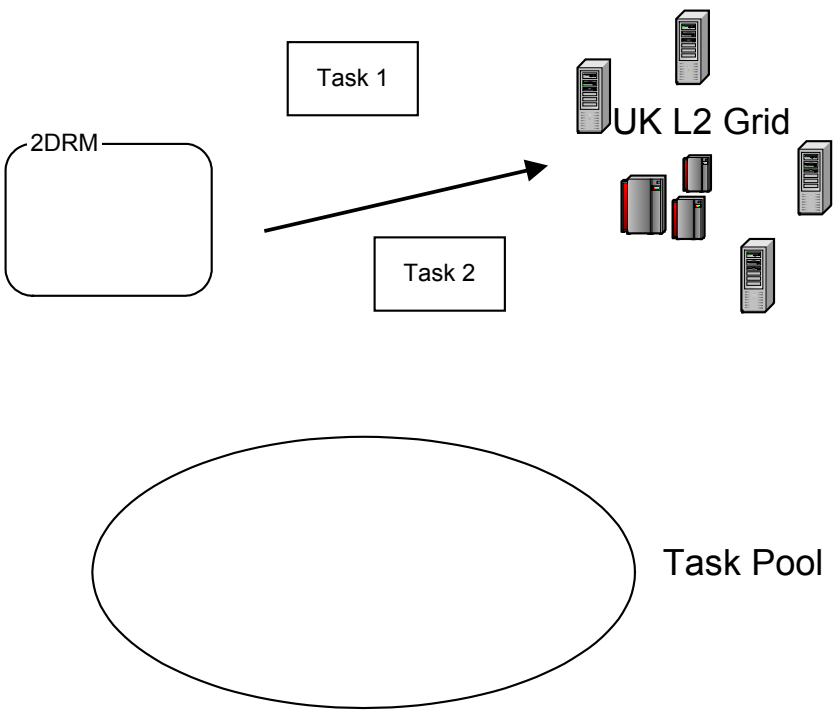
- Stages 1 & 2 construct atomic basis functions
- Stage 3 constructs sub-region Hamiltonian matrices
- Stage 4 diagonalises the sub-region matrices
- Stage 5 constructs surface amplitudes
- Stage 6 propagates local R-matrices across sub-regions
- Stage 7 is a 1-D propagation step

2DRM-G Solution Architecture

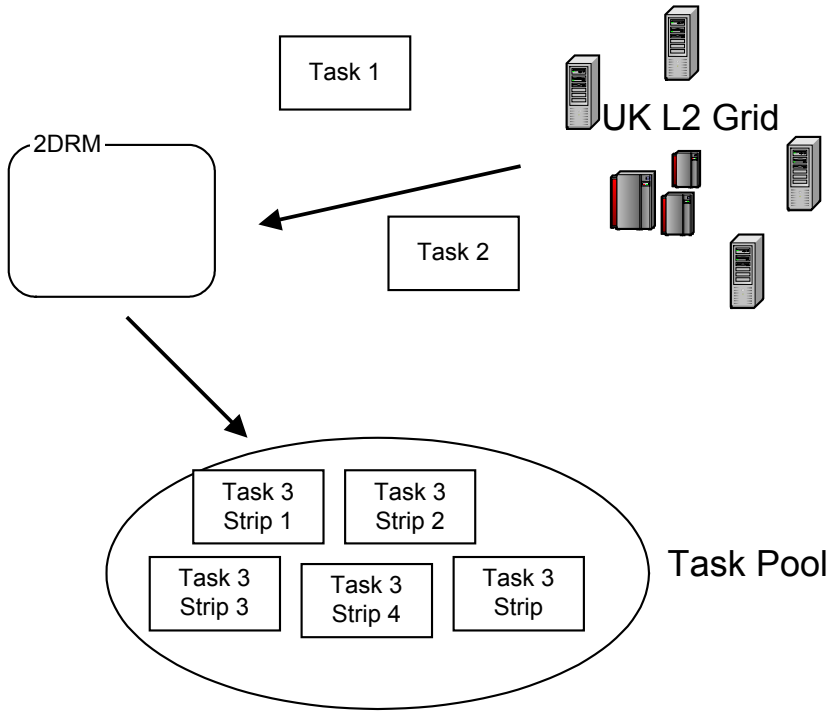


- A client that enables job monitoring.
- A resource list (from UK MDS), pool of tasks, resource-task matcher, workflow co-ordinator and job controller.

Solution Operation



Tasks 1 and 2 are matched with available resources



Completion of Tasks 1 and 2 schedules all of Task 3

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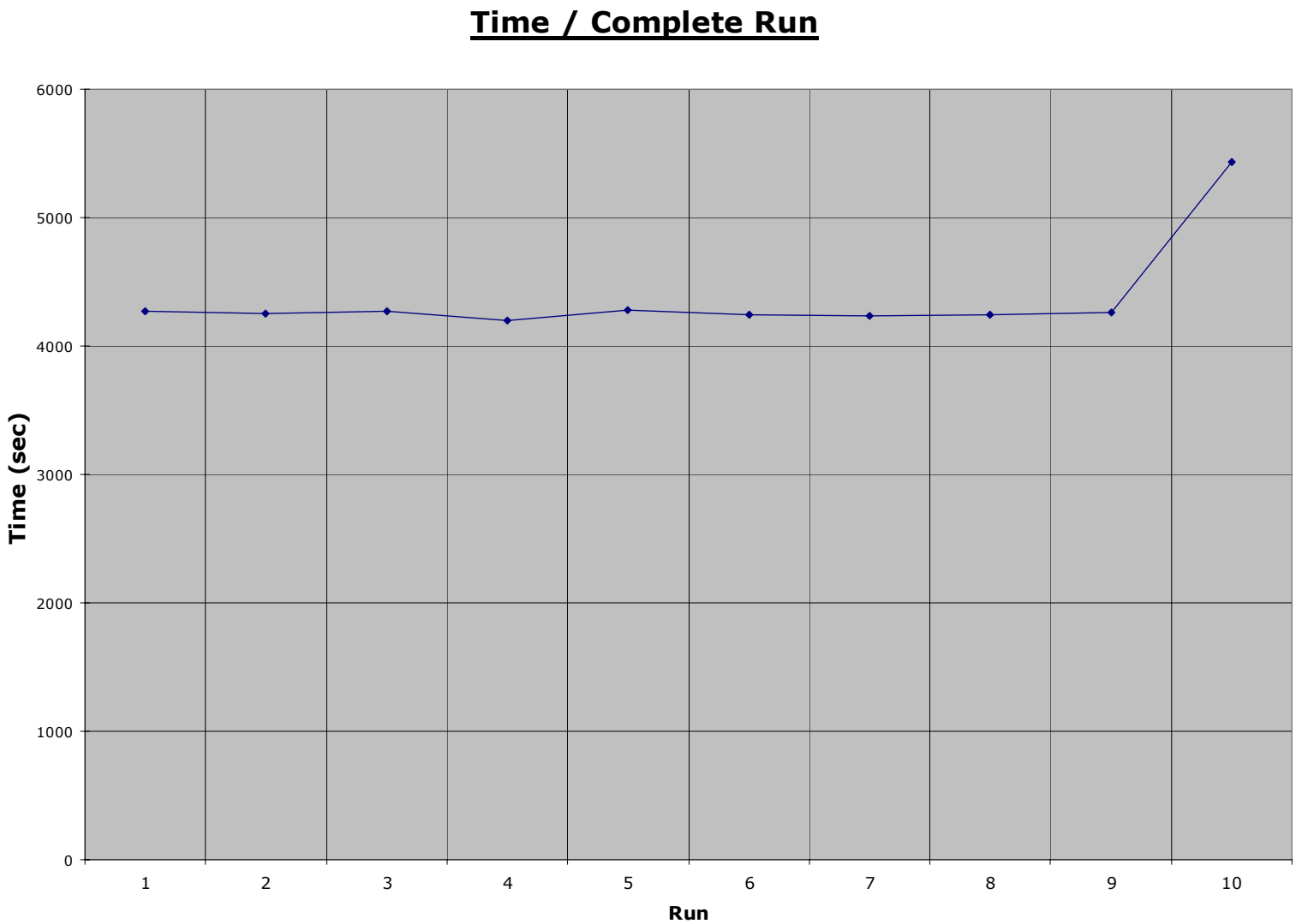
Execution Time:
Averages Over Last 10 Months



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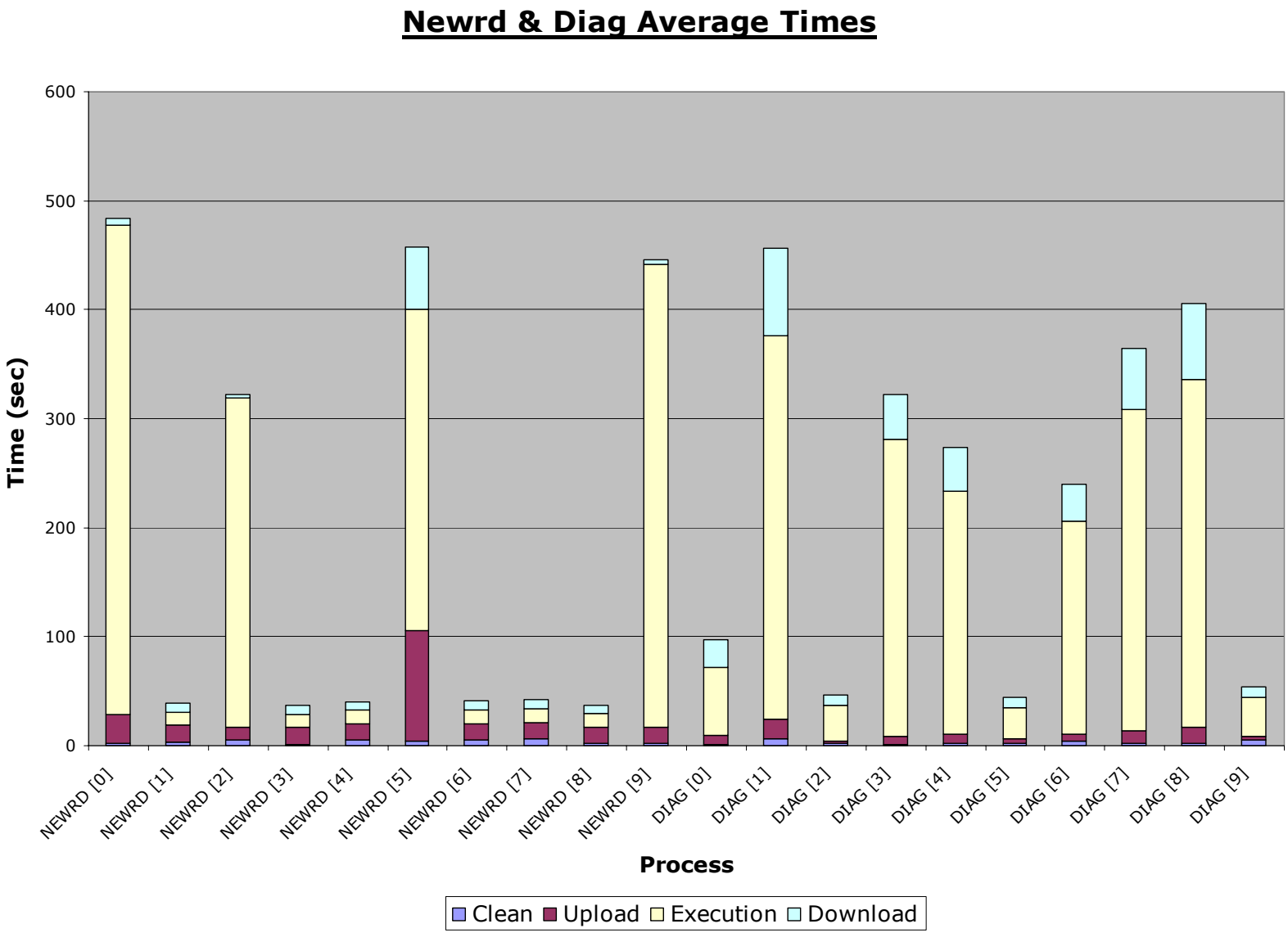
Time per Grid Task



Results Turn Around Time

…the controversial bit…

Machine	Time
HPCX	50 secs Queue time ~1 hour
L2G	About 1 hour

GridCast

Using the Grid in Broadcast Media Infrastructures

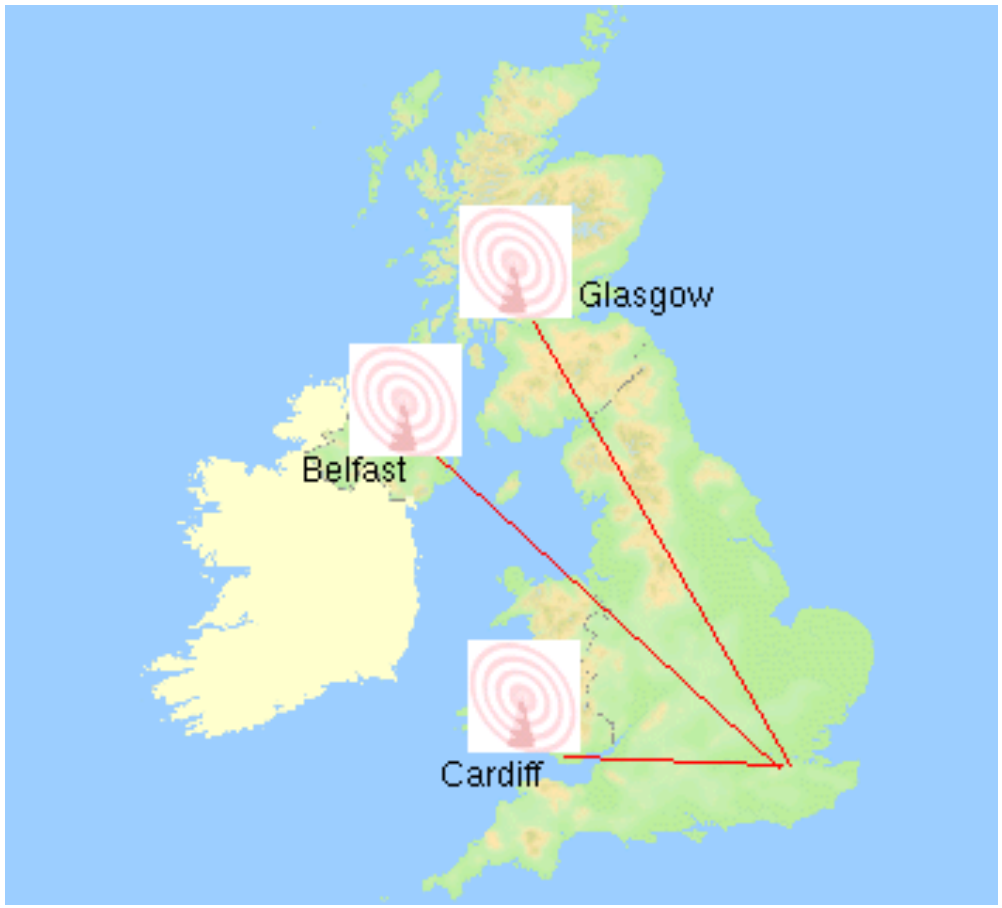
British Broadcast Corporation

British Telecom (NI)

Project Overview

- To develop a baseline media grid to support a broadcaster
  - *Manage distributed collections of stored media*
  - Prototype security and access mechanisms
  - Integrate processing and technical resources
  - Integrate with media standards and hardware
- To analyse *Quality of Service* issues
  - Analyse remote content distribution infrastructures
  - Measure QoS issues in distributed media collections
  - Analyse remote service provision
  - *To analyse reactivity, reliability and resilience issues in a grid-based broadcast infrastructure*

The Grid Scenario: The BBC Nations BBC NI, BBC Scotland and BBC Wales

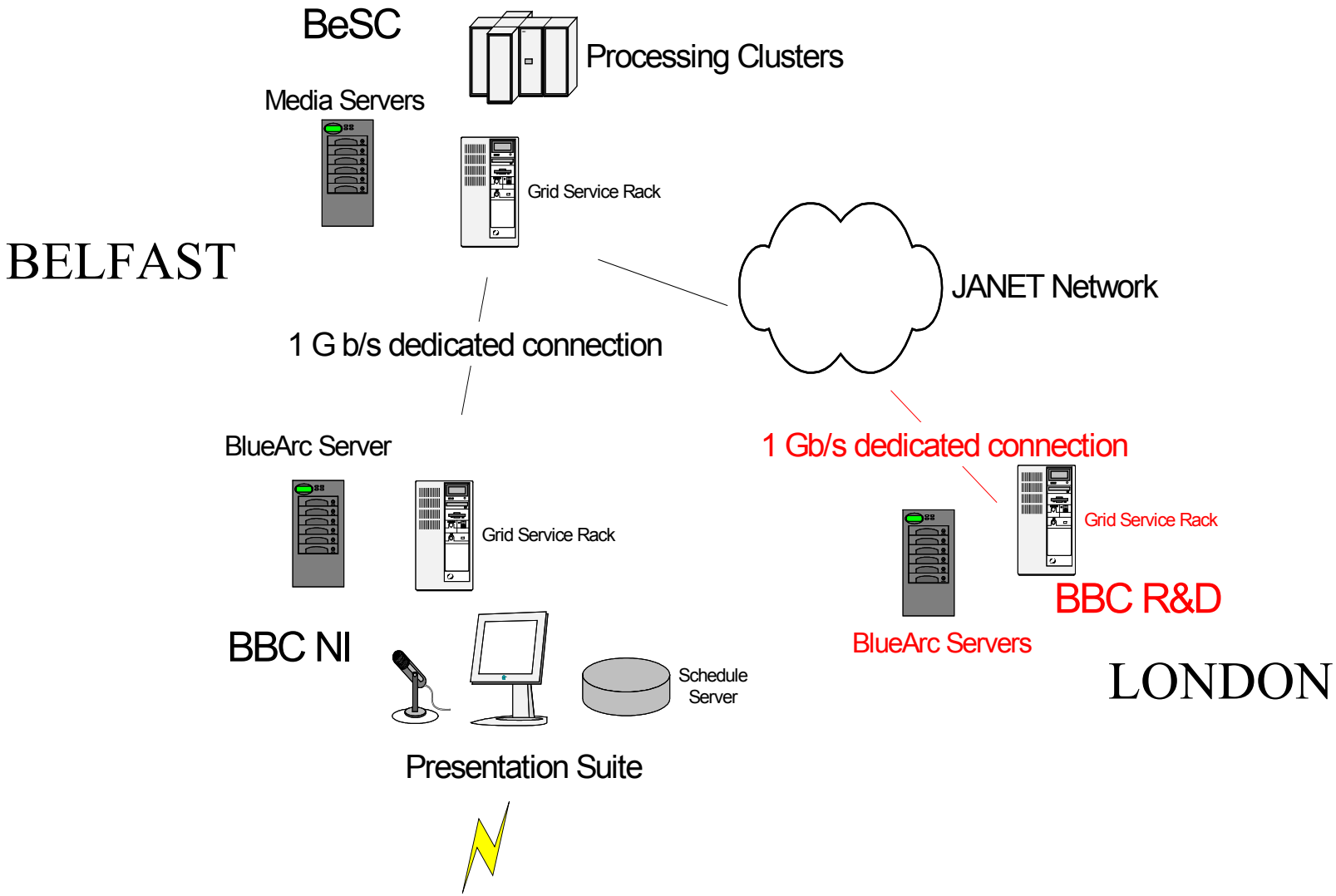


- BBC Nations provide customised services in each nation
- Television programmes are distributed to BBC Nations from BBC Network (London) using dedicated leased ATM circuits.

Development History

- Project Started in April 2003
  - GT3/Web services based
    - Starting as a GT3 Alpha system in March 2003!
- Infrastructure is in place and the QoS testing is ongoing
  - A small part of this is reported here

GridCast Media Grid

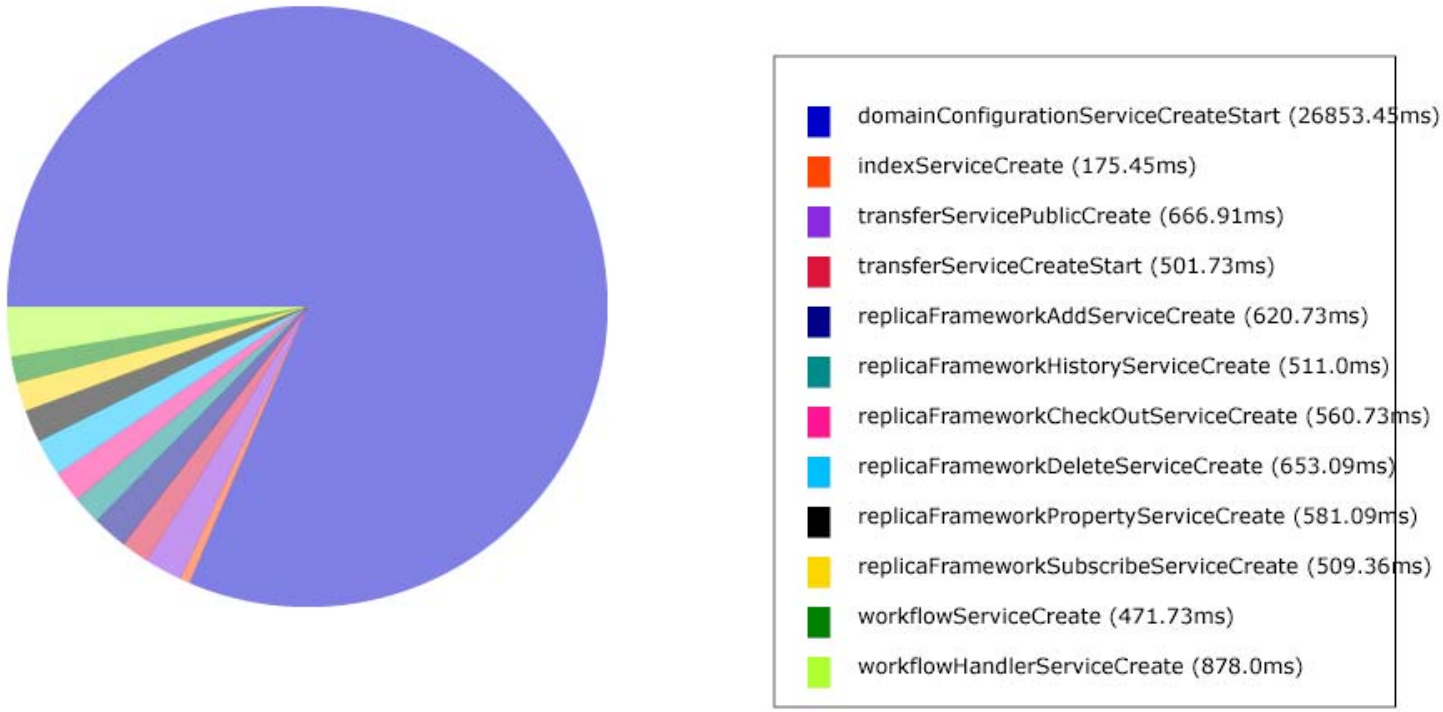


Test Scenario

- Reflects broadcast infrastructure pattern of use.
  - Intense short periods of activity
  - Reflects usage to co-ordinate broadcasting of content
    - At programme broadcast junctions

Domain Creation Average Timings

Pie chart showing break-down of service activity timings on a domain



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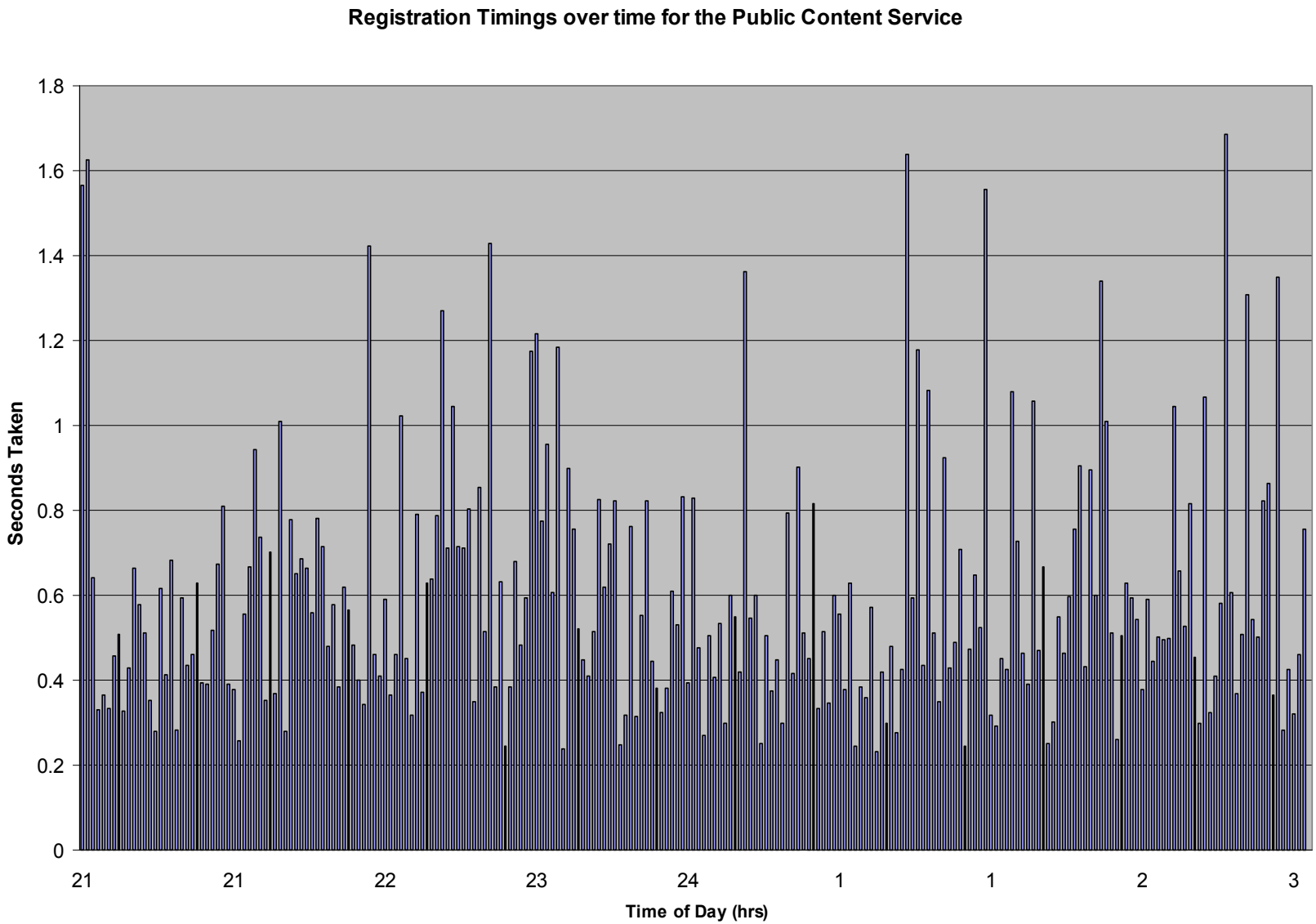
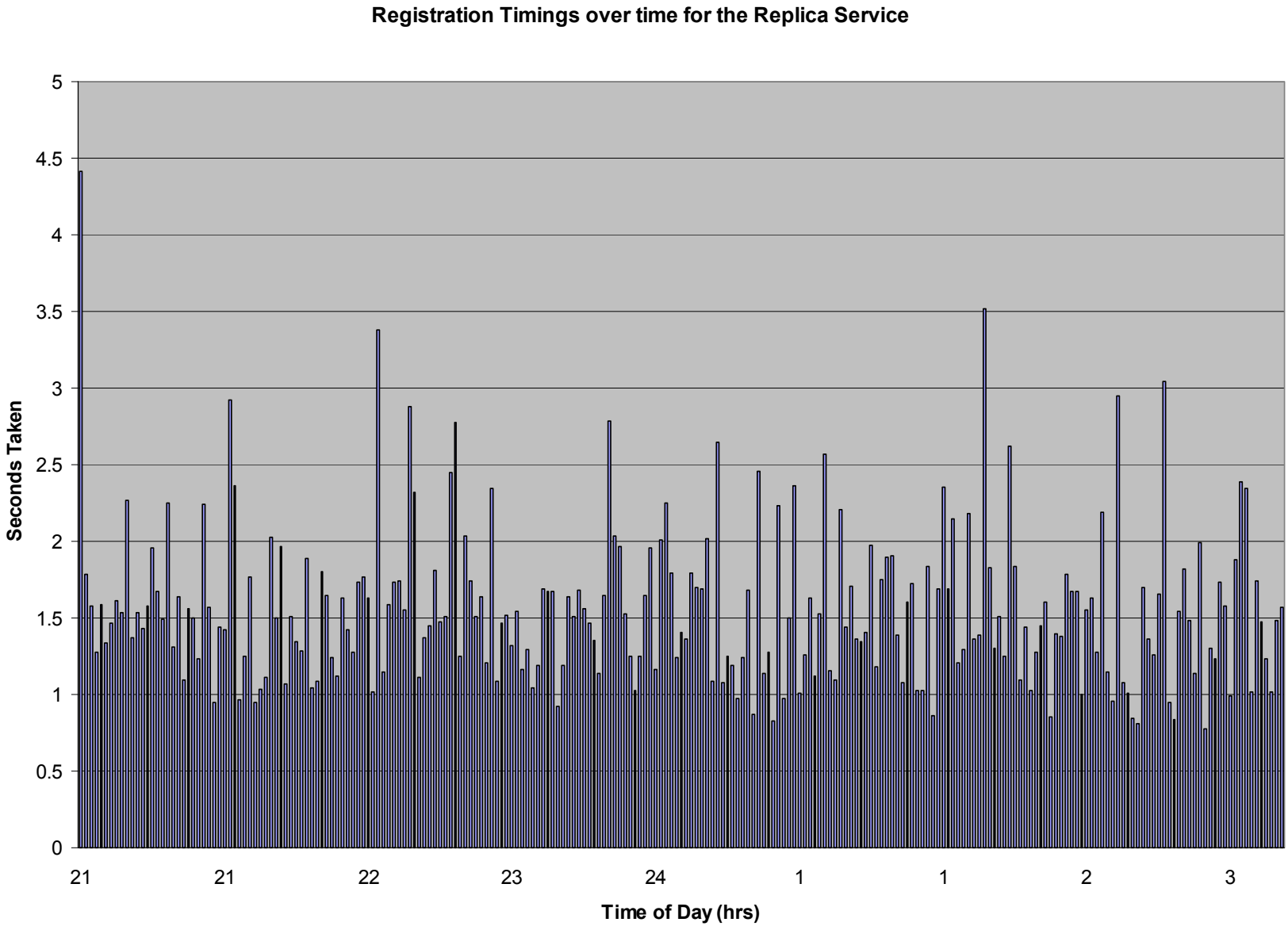
Service Registration



Creating a Replica

Service Time Only



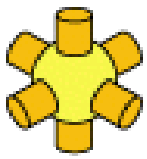
GridCast Issue Summary

- Invoking a service securely takes several seconds

- Not really a problem (currently) in GridCast because we are interested in managing very large media content files
  - Currently 25Gbyte per hour to 180Gbyte per hour
  - Reactivity for non content-based services will be an issue.

GEDDM

Grid **E**nabled **D**istributed **D**ata **M**ining



datactics

Innovations in Data Matching

GEDDM

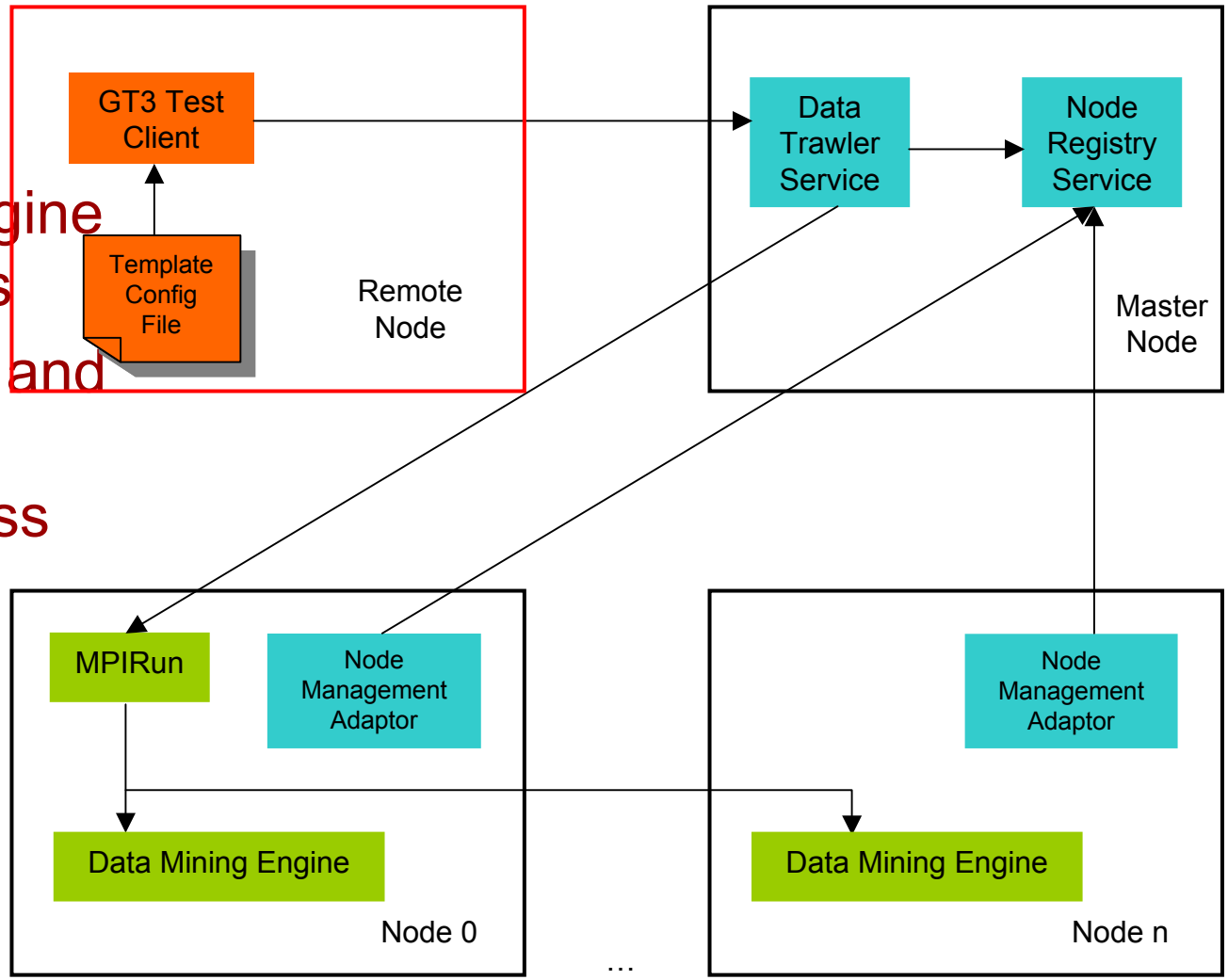
- Distributed Data Mining and Conversion of Unstructured data
  - Email, pdf, weblogs, RDBMS, Word, files …
- Specialising in grid enabled "data-centric" matching across multiple sectors
- *Computationally intensive - need to compare every record with every other record*
- Improve data quality by applying fuzzy matching and parallel processing to achieve greater depth and accuracy
  - Scenarios based on
    - Forensic accounting, Banking, anti-terrorist, crime
- Data mining software being used in the real world

Development History

- Mining engine has been in commercial use since 1999
- GEDDM project in development since September 2003
  - GT3/web services based
  - Interested in utility computing and remote mining service provisioning.

GEDDM Architecture

- Use Grid Technology
- Expose core engine as Grid Services
- Secure, reliable and scaleable High bandwidth access



Mining Engine

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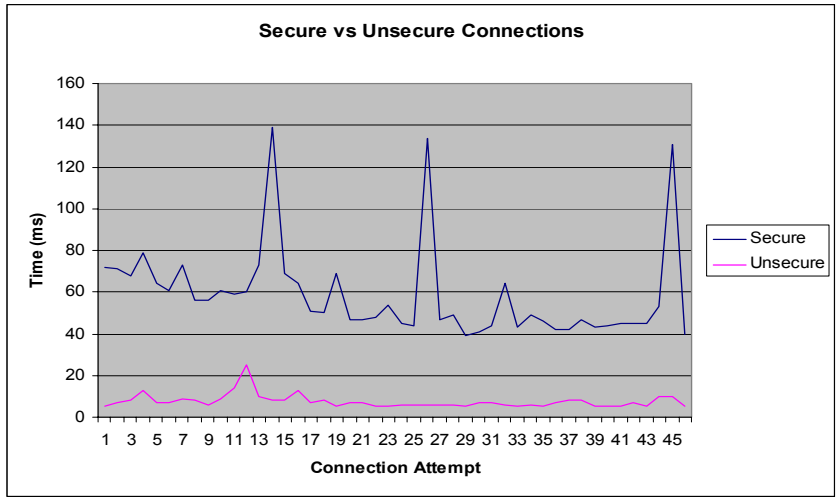
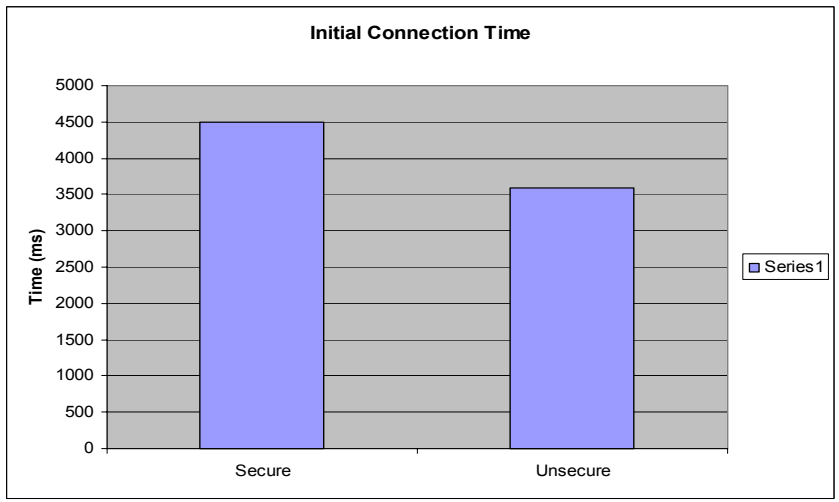
GEDDM Performance I

- Java client connecting to grid services
- Secure connection uses GT3 Message Level Security





GEDDM Performance I

- Core Data Mining Engine
  - 1Million records – 3 seconds
    (2 seconds – initialisation, 1 sec matching)
- Grid Services
  - GT3 Java, x509 etc
  - Client to DT service
  - Service access time ***4 seconds***

- ***Service access time is an issue….***